Atty. Docket No. PIA30962/DBE/US
Serial No: 10/712,945

Remarks

Applicant and Applicant's undersigned representative thank Examiner Arena for the thorough examination of the present application and the detailed explanations in the Final Office Action dated January 10, 2006.

The present Amendment is filed to address all issues identified by the Examiner and place the application into condition for allowance. Claims 12 – 16 were amended to clarify and more clearly describe the claimed subject matter. Claim 21 has been cancelled.

The Rejections of the Claims under 35 U.S.C. §112, First Paragraph

The rejections of claims 12, 14, and 21 under 35 U.S.C. §112, first paragraph, have been obviated by appropriate amendment. Specifically, claim 12 as amended recites a structure where the first metal lines are formed on a substrate and the second metal lines are formed on the first metal lines. Claim 14 as amended recites a first conductive layer formed of an Al alloy containing not greater than 5% Cu, which is disclosed in the specification (Para. [0011]). Claim 21 has been cancelled.

Amended claims 12 and 14 recite subject matter which is believed to be consistent with that contained in the original application, and thus, no new matter has been introduced. As a result, this ground of rejection is unsustainable, and should be withdrawn.

The Rejections of the Claims under 35 U.S.C. § 102(e)

The rejections of claims 12, 13, 15, 16, 20 and 21 under 35 U.S.C. § 102(e) as being anticipated by Anand (US 6,500,748) is respectfully traversed.

Anand discloses a semiconductor device comprising second metal lines formed on first metal lines; each metal line further comprising a barrier metal layer and a conductive layer. The conductive layers of both the first and second metal lines comprise "aluminum, copper or an

alloy of these metals" (Col. 7, ll. 66 – 67; Col. 8, ll. 66 – 67). Anand does not further teach the selection of particular metals for either the first or second conductive layers. Thus, both the first and second conductive layers of Anand may comprise the same metal (e.g., both can be Cu, both can be Al, both can be an alloy of Al and Cu, or one can be Al and the other an alloy of Al and Cu).

In contrast, claim 12 of the present invention recites a structure in which a first conductive layer is formed of a material different from that of the second conductive layer. A benefit of this "hybrid metal line" structure (e.g., Al-Cu alloy for the first metal line and Cu for the second) is that the first metal line prevents ions of the second metal line from being diffused into the substrate (claim 12). It is not known how the first metal line could prevent ions of the second metal line from diffusing into the substrate in the embodiments of Anand which use the same metal for both the first and second conductive layers.

Anand does not affirmatively disclose an embodiment where the first and second metal lines are formed of different materials. As such, Anand does not appear to enable a structure where the first metal lines prevent ions of the second metal lines from being diffused into the substrate. Therefore, Anand does not anticipate the present claims. Consequently, this ground of rejection is unsustainable, and should be withdrawn.

The Rejection of Claim 14 under 35 U.S.C. § 103(a)

The rejection of claim 14 under 35 U.S.C. § 103(a) as being unpatentable over Anand (US 6,500,748) in view of Xu et al. (US 5,847,461) is respectfully traversed.

Anand discloses a first conductive layer formed of an Al alloy. However, Anand fails to specifically disclose an Al alloy containing not greater than 5% Cu. Further, as recited above, Anand fails to disclose a first conductive layer formed of a material different than that of the second conductive layer such that the first metal lines prevent ions of the second metal lines from being diffused into the substrate. Thus, Anand is deficient with respect to the present claims.

Xu et al. discloses a single metal line structure comprising a barrier metal layer and a conductive layer wherein the conductive layer is formed by extruding a compressively stressed metal layer. The compressively stressed metal layer of Xu et al. may comprise "any electrically conductive metal layer capable of being formed as a layer in compressive stress" including aluminum, gold, silver, platinum, alloys and the like (Col. 4; ll. 29 – 36). The composition of a compressively stressed metal layer must be chosen dependant on the extrusion method since the extrusion must be performed at a temperature "below the melting point of [the] metal layer... since the use of a temperature as high as the melting point of the layer would be detrimental to other portions of the integrated circuit structure" (Col. 7; ll. 9 – 13) and the time "will vary with different metals and with different temperatures" (Col. 7; ll. 38 – 39). Assuming arguendo that the compressively stressed metal layer of Xu et al. comprising an Al alloy containing not greater than 10% Cu is the same as the first conductive layer of the present invention, Xu et al. fails to cure the deficiency of Anand with respect to a first conductive layer formed of a material different than that of a second conductive layer such that the first metal lines prevent ions of the second metal lines from being diffused into the substrate.

Consequently, no possible combination of Anand and Xu et al. can suggest the formation of a stacked hybrid structure wherein a first conductive layer is formed of a material different from that of a second conductive layer such that the first metal lines prevent ions of the second metal lines from being diffused into the substrate. Therefore, this ground of rejection is unsustainable, and should be withdrawn.

The Rejection of Claim 14 under 35 U.S.C. § 103(a)

The rejection of claims 17 – 19 under 35 U.S.C. § 103(a) as being unpatentable over Anand (US 6,500,748) in view of Reference "U" (Abstract from Materials Research Society's Spring 97 Meeting entitled "Thermal stability study of the interconnect system with fluorinated silicate glass as IMD layers") is respectfully traversed.

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As discussed above, Anand fails to disclose a first conductive layer formed of a material different than that of the second conductive layer such that the first metal lines prevent ions of the second metal lines from being diffused into the substrate. Thus, Anand is deficient with respect to the present claims.

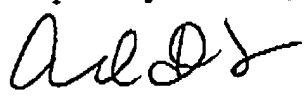
Reference "U", not provided to the Applicant by the Examiner or available to Applicant's representative at the location cited by the Examiner, recites that "FSG is usually combined with undoped oxide or polymer materials to form IMD layers" (See Abstract of N5.4, ll. 2 – 3). Reference "U" therefore fails to cure the deficiency of Anand with respect to claim 12.

Consequently, no possible combination of Anand and Reference "U" can suggest the formation of a stacked hybrid structure wherein a first conductive layer is formed of a material different from that of a second conductive layer such that the first metal lines prevent ions of the second metal lines from being diffused into the substrate. Therefore, this ground of rejection is unsustainable, and should be withdrawn.

Conclusions

In view of the above amendments and remarks, all bases for objection and rejection are overcome, and the application is in condition for allowance. Early notice to that effect is earnestly requested.

Respectfully submitted,



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